

(12) **United States Patent**
Meyer et al.

(10) **Patent No.:** **US 11,044,405 B1**
(45) **Date of Patent:** **Jun. 22, 2021**

(54) **LOCATION SYSTEMS FOR ELECTRONIC DEVICE INTERACTIONS WITH ENVIRONMENT**

(71) Applicant: **Apple Inc.**, Cupertino, CA (US)

(72) Inventors: **Adam S. Meyer**, Cupertino, CA (US); **Peter C. Tsoi**, San Jose, CA (US); **Duncan Robert Kerr**, San Francisco, CA (US); **Martha Evans Hankey**, San Francisco, CA (US); **John B. Morrell**, Los Gatos, CA (US); **James H. Foster**, Oxford (GB)

(73) Assignee: **Apple Inc.**, Cupertino, CA (US)

(*) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 0 days.

(21) Appl. No.: **15/696,636**

(22) Filed: **Sep. 6, 2017**

Related U.S. Application Data

(60) Provisional application No. 62/395,922, filed on Sep. 16, 2016.

(51) **Int. Cl.**
H04N 5/232 (2006.01)
H04W 4/02 (2018.01)
(Continued)

(52) **U.S. Cl.**
CPC **H04N 5/23293** (2013.01); **G06F 3/005** (2013.01); **G06F 3/0488** (2013.01);
(Continued)

(58) **Field of Classification Search**
CPC H04N 5/23293–232945; H04N 5/4403; H04N 2005/4405–4444;
(Continued)

(56) **References Cited**

U.S. PATENT DOCUMENTS

8,249,626 B2 8/2012 Huston
8,661,352 B2 2/2014 Gronow et al.
(Continued)

OTHER PUBLICATIONS

Fuentes-Pacheco, Jorge, et al., “Visual simultaneous localization and mapping: a survey”, Spring Science + Business B.V., Dec. 2012, [Retrieved on Sep. 9, 2016], Retrieved from the Internet: <URL: <https://www.researchgate.net/publication/234081012>>.

(Continued)

Primary Examiner — Quan Pham

(74) *Attorney, Agent, or Firm* — Treyz Law Group, P.C.; Kendall W. Abbasi

(57) **ABSTRACT**

An electronic device may be provided with control circuitry, wireless transceiver circuitry, and a display. The electronic device may be used to provide information to a user in response to being pointed at a particular object. The control circuitry may determine when the electronic device is pointed at a particular object using wireless control circuitry and/or motion sensor circuitry. In response to determining that the electronic device is pointed at a particular object, the control circuitry may take suitable action. This may include, for example, displaying information about an object when the electronic device is pointed at the object, displaying control icons for electronic equipment when the electronic device is pointed at the electronic equipment, and/or displaying a virtual object when the electronic device is pointed at real world object.

15 Claims, 12 Drawing Sheets

